Visit us - www.researchjournal.co.in ■ DOI : 10.15740/HAS/IRJAES/7.2/169-174
International Research Journal of Agricultural Economics and Statistics
Volume 7 | Issue 2 | September, 2016 | 169-174 ■ e ISSN-2231-6434

Research Paper

Price stability of soybean for major markets of India

■ A.S. TINGRE, A.A. BHOPALE AND R.G. DESHMUKH

See end of the paper for authors' affiliations

Correspondence to :
A.S. TINGRE
Department of Agricultural Economics and Statistics, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, AKOLA (M.S.) INDIA

ABSTRACT : Soybean is the leading oilseed produced globally. Huge fluctuations in prices of farm produce are observed during past few years. The present study aimed to study price movement of soybean *i.e.* seasonal variations, price volatility and co-integration among the major soybean markets in India. For study purpose the data related to monthly average prices of soybean were collected from major markets of different states *viz.*, Akola and Latur (Maharashtra), Kota (Rajasthan), Bailhongal (Karnataka) and Nizamabad (Andhra Pradesh) for the period 2001-2013. Moving average method was used to study seasonal variations. The econometric tools like ADF test, Johansen's multiple co-integration test, granger causality test and ARCH-GARCH model were used to arrive at conclusions. The results of study showed that the prices of soybean were higher in the months from June to August in all selected markets. For all selected markets the prices series are free from the consequences of unit root and were stationary at first difference. The selected markets show long run equilibrium relationship and co-integration between them. Most of the markets showed bidirectional influence on soybean prices of each other. Akola, Bailhongal, Kota and Latur market, recorded high price volatility in Soybean prices.

KEY WORDS : ADF test, ARCH- GARCH, Co-integration, Granger causality test, Price movement, Price volatility, Seasonal variation

***Paper History* :**
Received : *01.04.2016;*
Revised : *16.07.2016;*
Accepted : *14.08.2016*

HOW TO CITE THIS PAPER : Tingre, A.S., Bhopale, A.A. and Deshmukh, R.G. (2016). Price stability of soybean for major markets of India. *Internat. Res. J. Agric. Eco. & Stat.*, **7** (2) : 169-174, **DOI : 10.15740/HAS/IRJAES/7.2/169-174.**

INTRODUCTION :

The soybean (*Glycine max* L.) is a species of legume, popularly known as the "GOLDEN BEAN" or "MIRACLE BEAN" of the 21st century. The plant is classed as an oilseed rather than a pulse. Soybean is an important source of high quality but inexpensive protein and oil. Soybean is the leading oilseed produced globally. India ranks 5th in the list of major soybean producing countries of the world by producing about 3-4 per cent of the global production. Soybean is fastest growing crop in India which replaced the crops like maize, cotton and pulses. Huge fluctuations in prices of farm produce are observed during past few years. The major factors influencing on prices of soybean are the arrivals in market, climatic conditions during the various growth stages, carry forward stocks, price movement over the period of time, crop condition through out the country, export and import, global and domestic demand and supply, etc. Seasonal variations observed in prices of soybean. In the peak arrival months the prices of soybean declined while in lean period they rises. The markets of soybean in India are co integrated and they influences on prices of each other. For better marketing of any agricultural commodity the information

regarding seasonality, seasonal variations, price volatility, price movement across the state and country, etc. is necessary. Analyzing the past trend in the price of commodities is also useful in understanding the present scenario and to formulate appropriate strategies to improve the marketing system. The study of seasonal variations is considered to be important as a guide to the producer to market his products and to the consumer to purchase his needs at the right time. It also serves as a guide to the Government to operate its policy measures (procurement and buffer release) at the appropriate time. Therefore, the present study has undertaken with following specific objectives :

–To study the seasonal variations in prices of Soybean.

–To assess the price volatility and co-integration among the major Soybean markets in India.

MATERIALS AND METHODS :

For study purpose the major soybean markets from different states were selected *viz.*, Akola and Latur (Maharashtra), Kota (Rajastan), Bailhongal (Karnataka) and Nizamabad (Andhra Pradesh). As per the records available the time series data on monthly average prices of soybean for the period from 2001 to 2013 were collected from Agricultural Produce Market Committees of respective market and AGMARK net site.

Method of moving average :

The method of moving average most widely used method of measuring seasonal fluctuations and the seasonal indices were obtained with following steps.

–Twelve month centered moving average value for given market arrivals and prices data were obtained.

– The original value as a percentage of centered moving average values for all months were expressed, except for first six month and six month at the end.

–These percentage were arranged according to the years and month. Primarily seasonal indices were obtained on eliminating the irregular component by averaging these percentage for each month. The average was taken over different year.

Augmented dickey-fuller test (ADF) :

Before analyzing any time series data testing for stationarity is per-requisite. First the test for stationarity of time series data on soybean prices is conducted. An Augmented dickey-fuller test (ADF) is the test for a unit root in a time series sample. A stationary series is one whose parameters are independent of time, exhibiting constant mean and variance and having autocorrelations that are invariant through time. It the series is found to be non-stationary, the first differences of the series are tested for stationarity. The number of times (d) a series is differenced to make it stationary is referred to as the order of integration, I(d).

ADF unit root test are based on the following three regression forms:

– Without constant and trend $\Delta Y_t = \delta Y_{t-1} + u_t$

– With constant

$\Delta Yt = \alpha + \beta T + \delta Yt\text{-}1 + ut$

– With constant and trend

The hypothesis is: H_0: $\delta = 0$ (Unit root)

H_0: $\delta \neq 0$

t* > ADF critical value then accept the Null hypothesis, *i.e.* unit root exists.

t* < ADF critical value then reject the Null hypothesis, *i.e.* unit root does not exists.

Johansen's multiple co-integration test :

Johansen's multiple co-integration test is employed to determine the long rum relationship between the price series. The test shows whether the selected soybean markets are integrated or not. Johansen (1988) has developed a multivariate system of equations approach, which allows for simultaneous adjustment of both or even more than two variables. The multivariate system of equations approach is more efficient than single equation approach *i.e.* it allows to estimate the co-integration vector with smaller variance. The second advantage of the multivariate approach is that in the simultaneous estimation it is not necessary to presuppose erogeneity of either of the variables.

Granger causality tests :

In order to know the direction of causation between the markets granger causality test was employed. When a co-integration relationship is present for two variables, a granger causality test (Granger, 1969) can be used to analysis the direction of this co-movement relationship. Granger causality tests come in pairs, testing weather variable xt granger-causes variable yt and *vice versa*. All permutations are possible: univariate granger causality from xt to yt or from yt to xt, bivariate causality or absence of causality. Formally, the granger causality test analyses

weather the unrestricted equation :

$$y_t = \sim_0 + \rho T_i = 1 \sim_1 i\, y_{t-i} + \rho T_j = 1 \sim_2 i\, x_{t-j} + £_t \text{ with } 0 \le i, j \le T$$

Yield better results than the restricted equation :

$$Yt = 0 + \rho T_{i=} 1 \quad {}_1 i\, y_{t-i} + £_t \text{ with } \rho T_j = 1 \sim_2 j\, x_{t-j} = 0$$

(The Null hypothesis)

i.e. if H_0, in which $\alpha_{21=}\ \alpha_{22=\ldots\ldots=}\ \alpha_2 T = 0$, is rejected then one can state "variable x_t granger causes variable y_t".

ARCH-GARCH model :

To access the presence of price volatility the ARCH-GARCH analysis was carried out. Auto regressive conditional heteroscedastcity (ARCH) models are specifically designed to model and forecast conditional variances. ARCH model introduced by Engel (1982) and generalized as GARCH by Bollerslev (1986). The ARCH model have two distinct specifications one for the conditional variance and the standerd GARCH (1,1) specification is presented below:

$$Yt = ¥_0 + ¥_1 X_{1t} + \ldots\ldots\ldots + ¥_k X_{kt} + e \quad \ldots\ldots\ldots\ldots 1$$

$$±^2_t = \mu + \sim e^2_{t-1} + \quad ±^2_{t-1} \quad \ldots\ldots\ldots 2$$

Equation (1) is the mean equation and equation (2) is the conditional variance equation. The ARCH component (α) indicate the lag of the squared residual from the mean equation and the GARCH term (β) the last period's forecast variance and the resultant sum of these co-efficient ($\alpha + \beta$) are presented. The sum of co-efficients very close to 1would indicate that the volatility shocks are quite persistent in the series.

RESULTS AND DATA ANALYSIS :

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Seasonal variations :

The arrivals of soybean start hitting in the market from the month of October and continue for next five to six months. The peak period of arrivals is October to March. Due to large arrivals during this period the prices decline. The lean period is from June to September. The prices were recorded higher from April to August. Most of the traders release the stored stock of soybean during this period in anticipation of making the profit. The seasonal indices of monthly average prices of soybean in Akola, Latur, Nizamabad, Kota and Bailhongal markets were worked out to study seasonal variations, which are presented in Table 1.

From Table 1 it is observed that in selected markets

Table 1 : Seasonal indices of monthly average prices of soybean in different markets of India

Months	Akola (M.S.)	Latur (M.S.)	Nizamabad (A.P.)	Kota (R.J.)	Bailhongal (K.A.)
January	99.43	96.90	104.96	98.30	98.31
February	99.06	98.30	104.36	98.06	99.24
March	102.23	99.33	94.24	101.80	100.96
April	103.53	102.64	99.14	100.32	103.61
May	104.14	103.29	99.59	101.69	103.83
June	103.40	106.78	100.45	104.73	106.56
July	106.75	106.62	97.52	104.13	98.66
August	95.01	104.08	102.10	103.77	104.33
September	90.03	99.17	98.01	99.03	101.60
October	95.50	89.63	93.64	92.45	91.04
November	99.09	95.47	104.09	94.91	94.76
December	101.84	97.80	101.89	100.80	97.09

Table 2 : ADF test results of soybean prices

Market	Level	First difference	Critical value (1%)
Akola	-2.529228	-8.158641	-4.065702
Bailhongal	-2.905233	-10.18706	
Kota	-2.396841	-8.113473	
Latur	-3.014254	-7.9043	
Nizamabad	-4.108833	-11.70274	

the prices were higher from June to August. The higher prices attributed to less arrivals of soybean in the markets. All the markets recorded lower prices in the months from October to February except Nizamabad market. During these months the arrivals starts which lowered down the prices. Chandrakala (2009) found that the prices of ground nut were higher in lean arrivals period.

Augmented dickey-fuller test (ADF) :

The augmented dickey fuller (ADF) based on unit root test procedure is done to check weather soybean prices are stationary in the markets under study. From Table 2 it is observed that at level with lag 1, the ADF values are grater than critical values at 1 per cent level of significance indicating the existence of unit root implied

Table 3 : Results of multiple co-integration analysis

Domestic red gram market	Eigen value	Trace statistics	Critical value (5%)	Hypothesized number of CE (s)	No. of co-integration equation
Akola	0.411175	127.5031	88.80380	None*	Three
	0.347343	82.48489	63.87610	At most 1*	
	0.241644	46.21514	42.91525	At most 2*	
	0.158618	22.70393	25.87211	At most 3	
	0.090078	8.023649	12.51798	At most 4	

Table 4 : Results of pairewise granger causility test

Null hypothesis	Obs	F-statistic	Prob.
KOTA does not granger cause NZM	110	14.4184*	1.E-07
NZM does not granger cause KOTA		1.49393	0.2226
AKL does not granger cause NZM	110	7.40945*	0.0002
NZM does not granger cause AKL		1.87711	0.1402
LTR does not granger cause NZM	110	4.94320*	0.0034
NZM does not granger cause LTR		1.19640	0.3166
BHNL does not granger cause NZM	110	3.19253*	0.0280
NZM does not granger cause BHNL		7.97022*	0.0001
AKL does not granger cause KOTA	110	6.53379*	0.0005
KOTA does not granger cause AKL		6.16346*	0.0008
LTR does not granger cause KOTA	110	1.31076	0.2768
KOTA does not granger cause LTR		5.49834*	0.0018
BHNL does not granger cause KOTA	110	3.85792*	0.0125
KOTA does not granger cause BHNL		14.2027*	2.E-07
LTR does not Granger Cause AKL	110	0.79433	0.5007
AKL does not Granger Cause LTR		4.49471*	0.0058
BHNL does not Granger Cause AKL	110	12.5018*	9.E-07
AKL does not Granger Cause BHNL		16.5720*	2.E-08
BHNL does not Granger Cause LTR	110	8.23998*	8.E-05
LTR does not Granger Cause BHNL		12.2303*	1.E-06

Series ; AKL, LTR, NZM, Kota and BHNL, AKL : Akola market , LTR : Latur market, NZM: Nizamabad market, BHNL: Bailhongal market

Table 5 : Results of ARCH-GARCH analysis

Parameter	Akola	Bailhongal	Kota	Latur	Nizamabad
Alpha (α)	0.911831	0.996190	0.853613	0.960556	0.799702
Beta (β)	0.196043	0.653328	0.208412	0.024418	-0.119915
Sum of α and β	1.107874	1.649518	1.062025	0.984974	0.679787

that the prices series in all markets are non-stationary at level except Nizamabad market which recorded lower ADF values than that of critical values at 1 per cent level. This implied that the soybean price series of Nizamabad market was stationary at level. The table further showed that in first difference with lag 1, the ADF values are lower than the critical values at 1 per cent level indicated that the prices series are free from the consequences of unit root. This implied that the prices series were stationary at 1st difference level. Ghosh (2011) found the prices of rice and wheat were non-stationary in levels but stationary in first-differences implied that all the series of rice and wheat prices contain a single unit root and are integrated of order one, I(1) for both the periods.

Johansen's multiple co-integration test :

Johansen's multiple co-integration test is employed to determine the long rum relationship between the price series. The test shows whether the selected soybean markets are integrated or not. The results of the test presented in Table 3.

The results of co-integration test showed that three co-integration equations were significant at 5 per cent level of significance indicated that the selected soybean markets having long run equilibrium relationship and there exists co-integration between them. Mukim *et al.* (2009) found the wholesale prices of wheat were co-integrated in the long run. Similar results recorded by Gandhi and Koshy (2006) and Ghosh (2011).

Granger causality tests :

In order to know the direction of causation between the markets granger causality test was employed. When a co-integration relationship is present for two variables, a granger causality test (Granger, 1969) can be used to analyze the direction of this co-movement relationship. Theoretically, a variable is said to granger-cause another variable, if the current value is conditional on the past value.

The results of pair wise granger causality test applied to the major soybean markets were presented in Table 4. It was observed that there is bidirectional influences on soybean prices of Nizamabad and Bailhongal, Akola and Kota, Bailhongal and Kota, Bailhongal and Akola and Bailhongal and Latur.

Price volatility :

To asses the presence of price fluctuations in the prices of soybean in Akola, Bailhongal, Kota, Latur and Nizamabad market ARCH-GARCH analysis is carried out and presented in Table 5. It was observed that among the markets, the sum of Alpha and Beta are nearer to 1 for Akola, Bailhongal, Kota and Latur market, worked out to 1.107874, 1.649518, 1.062025 and 0.984974, respectively, indicated that the presence of price fluctuations in soybean prices during the study period and the volatility shocks are quiet persistent in these markets.

Conclusion :

The study examined the price movement of soybean across the major markets in major soybean producing states of India. In selected markets the soybean prices were higher from June to August. The results of ADF test showed that except Nijamabad all the markets having the ADF values lower than the critical values at 1 per cent level indicated that the price series are stationary at first difference level. The analysis of multiple co-integration depicted that the selected markets having long run equilibrium relationship and their exists co-integration between them. There was bidirectional influences on soybean prices of Nizamabad and Bailhongal, Akola and Kota, Bailhongal and Kota, Bailhongal and Akola and Bailhongal and Latur. As the sum of Alpha and Beta worked out nearer to 1 for Akola, Bailhongal, Kota and Latur market, this indicated high price volatility in soybean prices in these markets.

Policy implication :

In order to minimize the price risk and to protect the price security of farming community in terms of soybean marketing it is suggested that long term concrete procurement policy should be adopted to maintain price stability throughout the year at least for major markets of the country.

Authors' affiliations:
A.A.BHOPALE AND R.G. DESHMUKH, Department of Agricultural Economics and Statistics, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, AKOLA (M.S.) INDIA

LITERATURE CITED :

Ajjan, N., Shivkumar, K.M., Murugananthi, D. and Padmavathi, P. (2009). Red chillies. CARDS commodity series – 2 Tamil Nadu Agricultural University, Coimbatore (T.N.) INDIA.

Bollerslev, T. (1986). Generalized autoregressive conditional heteroscedasticity. *J. Econometrics,* **31**: 307–327.

Chandrakala, S. Kallimath (2009). Spatile and temporal behaviour of arrivals and prices of groundnut in Karnataka-An econometric analysis.MBA (Agribusiness) Thesis, University of Agricultural Sciences, Dharwad (KARNATAKA) INDIA.

Engle, R.F. and Granger, C.W.J. (1987). Cointegration and error correction: Representation, estimation and testing. *Econometrica*, **55** (2) : 251-276.

Gandhi, Vasant P. and Abraham, Koshy (2006). Wheat marketing and its efficiency in India. Working paper No.2006-09-03 (Indian Institute of Management).

Gosh, Madhusudan (2011). Agricultural policy reforms and spatial integration of food grain markets in India. *J. Econ. Develop.*, **36** (2) : 15-36.

Lavanya, M. (2011). Price behaviour and marketing practices of turmeric in erode district of Tamil Nadu. M.Sc. Thesis, Tamil Nadu Agricultural University, Coimbatore, T.N. (INDIA).

Mukim, Megha, Singh, Karan and Kanakaraj, A. (2009). Market integration, transaction costs and the Indian wheat market: A systematic study. *Econ. & Polit. Weekly*, **44** (22): 149-155.

Sekhar, C.S. C. (2003). Volatility of agricultural prices – an analysis of major international and domestic markets. Working Paper No. 103 (Indian Council For Research On International Economic Relations).

7th Year
★★★★★ of Excellence ★★★★★